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PCT/KR2004/001651

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Artcle 36 and Rule 70)

Applicant's or agent's file reference PH-21689-PCT	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. **PCT/KR2004/001651**	International filing date *(day/month/year)* **05 JULY 2004 (05.07.2004)**	Priority date *(day/month/year)* 05 JULY 2003 (05.07.2003)

International Patent Classification (IPC) or national classification and IPC

IPC7 C07D 487/22

Applicant

POSTECH FOUNDATION et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☐ (sent to the applicant and to the International Bureau) a total of _____ sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
04 FEBRUARY 2005 (04.02.2005)	28 JUNE 2005 (28.06.2005)
Name and mailing address of the IPEA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer JUNG, YOUNG JA Telephone No. 82-42-481-8164

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International aplication No.
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Box No. I Basis of the report

1. With regard to the **language,** this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☒ This report is based on translations from the original language into the following language English, which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☒ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this reort as "originally filed" and are not annexed to this report):*

   ☒ the international application as originally filed/furnished

   ☐ the description:
   pages _____ as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the claims:
   pages _____ as originally filed/furnished
   pages* _____ as amended (together with any statment) under Article 19
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the drawings:
   pages _____ as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)* : _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)*: _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

** If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-9	YES
	Claims		NO
Inventive step (IS)	Claims	1-9	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-9	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The following documents have been considered for the purpose of this report:

(D1) Hee-Joon Kim, et al., PNAS, Vol. 99, No. 8, (2002), p5007-5011
(D2) Eunsung Lee, et al., Angew. Chem. Int. Ed., Vol. 40, No. 2, (2001), p399-4402
(D3) Yong-beom Lim, et al., Bioconjugate chem. Vol. 13, No. 6, (2002), p1181-1185
(D4) Sang Yong Jon, et al., J. Am. Chem. Soc., Vol. 125, No. 34, (2003), p10186-10187
(D5) Haizhen Zhang, et al., J. Am. Chem. Soc. Vol. 125, No. 31, (2003), p9284-9285

D1 discloses the inclusion behavior of methylviologen (N,N'-dimethyl-4,4'-bipyridinium, MV) dication in cucurbit[7]uril(CB[7]) by using various spectroscopic and electrochemical methods. The inclusion complex of MV dication in CB[7] is stable thermodynamically and kinetically and this provides an insight to the design of novel molecular devices such as electrochemically controllable molecular machines.

D2 discloses the synthesis of a novel 2D polyrotaxane with large cavities and channels which demonstrates that this is indeed viable to modular porous solids.

D3 discloses that a ternary complex of PPI-DAB dendrimer [(1,4-diaminobutane); Gen=N; dendri-poly(propyleneimine);-[NHC(=O)CH(2)NH(2)(+)(CH(2))(4)NH(3)(+)](z)()], DNA, and cucurbituril(CB) is evaluated as an example of a totally self-assembled gene delivery carrier and the complex is formed in a noncovalent way in which DNA interacts with PPI-DAB electrostatistically and CB with PPI-DAB through multiple noncovalent interactions.

D4 relates to a facile synthesis of cucurbit[n]uril derivatives via direct functionalization and expanded utilization of cucurbit[n]uril. A CB[6] modified surface may be useful in designing sensors and biochips and CB[n] can be attached on silica surfaces which can be utilized as a stationary phase in chromatography.

(Continued in the Supplemental Box.)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box V

D5 discloses the electrospray ionization mass spectrometric experiments which demonstrate that cucurbit[6]uril pseudorotaxanes survive into the gas phase and exhibit dissociation and reactivity distinct from that of nonrotaxanes.

1. Novelty

None of the prior art documents D1 to D5 describe a compound represented by Formula 1 in which a compound of Formula 3 vertically passes through a cavity of cucurbituril or its derivative of Formula 2, a solid substrate bonded with the compound and a biochip including the solid substrate. Therefore, the subject-matter of claims 1-9 can be regarded as novel under PCT Article 33(2)

2. Inventive Step

According to the present invention, a rotaxane compound is used to separate molecules within a linkage layer formed on a solid substrate of a biochip by a predetermined distance. A rotaxane compound is introduced in a linkage layer, the spacing between adjacent linear compounds can be maintained at more than a diameter of cucurbituril, a linkage layer made of a rotaxane compound is formed on a solid substrate, and molecules which constitute the linkage layer can be spaced apart from each other by a predetermined distance.

The rotaxane compound of Formula 1 can be bonded to a modified solid substrate with various end functional groups to form a desired solid substrate and this substrate bonded with the rotaxane compound of Formula 1 can be used in preparation of a gene chip. Therefore, a rotaxane compound of the present invention allows the uniform spacing between rotaxane molecules within a linkage layer formed on a solid substrate. As a resultant, a biochip with selectivity and sensitivity can be produced.

Since the present invention is considered as being non-obvious to a person skilled in the art, and consequently an inventive step can be acknowledged for the subject-matter of claims 1 to 9 under PCT Article 33(3).

3. Industrial Applicability

The subject-matter of claims 1 to 9 is considered to be industrially applicable under PCT Article 33(4).